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The Industrial and Technical Challenge of the U.S.S.R.

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The Industrial and Technical Challenge of the U.S.S.R.

In less than thirty years the Soviet Union has been transformed from a relatively underdeveloped country to the second largest industrial economy in the world. The rate of industrial growth implied in this statement has been achieved in spite of the substantial destruction and dislocation of World War II. However, it has not resulted in the formation of an industrial base approximating our own in either size or power. Nevertheless, this base is large enough to permit the Soviet leaders to expand impressively their military capability, to take an increasingly active part in the development of underdeveloped areas and to speak confidently of "closing the gap" between our output and theirs. There are, therefore, both immediate and prospective challenges which flow directly from the Soviet industrial and technical effort. In order to assess this challenge realistically, it is of utmost importance that we understand how this rate of growth has been achieved, what the present relationship of Soviet industrial and technical strength is to that of the West and what the prospects are for the future.

The value of Soviet output as a whole has increased almost three-fold from 1926 to date. The rate of industrial growth during this period has been at least twice as high as the national average for the U.S.S.R. so that today industry is the most important sector of the Soviet Economy measured in terms of contribution to the national product. How has this rate of industrial growth been achieved? I would like to identify four factors which have been of major importance.

(1) An unusually large part of the total national product has been devoted to investment. We estimate that 24 percent of Soviet gross national product went directly into capital investment in 1955 - to increasing the base for future industrial growth and expanded military capabilities. The plans for the next five years indicate that this percentage will rise steadily. Only 18 percent of our own gross national product is currently being used for capital investment purposes. It is worth noting, also, that this is the highest percentage we have achieved in the postwar period.

Out of the total amount set aside for investment, heavy industry has been the major beneficiary and has enjoyed an even higher priority during the postwar period than it had prewar. We estimate that heavy industry is absorbing about 50 percent of total investment now compared with about 40 percent in the prewar years. As a result the plant and equipment available to industry has nearly tripled since 1940, while that of the national economy as a whole is estimated to have increased only 84 percent. That the Soviets not only have forced a high rate of investment in general, but that they have allocated investment funds predominantly in the direction of heavy industry - the coal, oil and electricity producing industries, and metalworking and metallurgical industries - is, therefore a critical factor in the Soviet industrial growth.

The high percentage in allocation of annual Soviet production to investment has been achieved at the expense of the present welfare of the population, which has been accorded minimum requirements in planning and a residual position in plan execution. Two examples make this clear:

(a) While capital goods output was rising over tenfold, agricultural production has barely kept pace with the growth of population.

(b) The ambitious plan goals for heavy industry are usually surpassed; the unimpressive goals for consumer goods, on the other hand, have not fared so well.

(2) In line with the emphasis on industrial growth, the Soviets have transferred millions of workers from agricultural to urban occupations. In spite of the normal growth of the labor force, we estimate that the agricultural labor force actually declined by some 6 percent between 1938 and 1952 and has barely made good this loss in the past three years. The non-agricultural labor force, on the other hand, increased by about 60 percent during this period.

(3) Fully as important as the physical shifting of labor from the farms to the cities has been the prodigious effort expended on scientific and technical education. Soviet colleges receive about 500,000 students and graduate about 250,000 each year. Total U.S. entrants and graduates are about 10 percent higher, but the Soviets train a far greater proportion in the sciences than we do. In 1955

about 60 percent of graduating full-time Soviet students were in scientific and technical fields compared with about 25 percent in the U.S. In 1955, the Soviet Union graduated from all schools about 60,000 in the physical sciences and engineering and about 50,000 in the biological sciences. In the U.S. about 37,000 were graduated in the physical sciences and 39,000 in the biological sciences. At this greater rate of graduation in sciences - now 130,000 annually in the Soviet Union as opposed to 77,000 in the U.S. -- the Soviets will attain an imposing advantage in number of scientist and engineers in a few years time if they and we continue at our present rates.

The U.S.S.R. now has about two thirds the number of scientists that the U.S. has in the research and teaching aspects of physical and biological sciences; 190,000 versus 280,000. In research alone, the U.S.S.R. has about half the U.S. number; 120,000 versus perhaps 240,000.

4 Finally, it is certainly true that up to this point in time at least, Soviet industry has advanced by relying on the accumulated Western scientific and technical development. By this means they have been able to telescope a century and a half of pains-taking research effort into a few years and to realize its benefits at relatively little cost to themselves. Moreover, they have been able to acquire the theoretical base essential to independent research in technology - a factor of tremendous significance when we consider the future relationship of the two economies.

The results of the Fifth Five Year Plan may be used to demonstrate how effective this policy of forced industrialization has been. Over this five year period Soviet industrial production grew over 75 percent compared to 23 percent in the U.S. during the same period. As was to be expected the output of heavy industry grew at an even higher rate than the industrial average. The consumer goods industries grew at a much slower rate than the industrial average and this combined with the slow growth in agriculture and consumer services resulted in only a modest improvement in the already low living standards.

Soviet gains up to this time have been spectacular by U.S. standards. However, it must also be observed that the high rates of growth achieved result in part from the fact that the base from which these rates are calculated was and is very low by U.S. standards. Small absolute additions to a small base yield high rates of growth. It is useful, therefore, to look briefly at this present level of output in the U.S.S.R. compared with the U.S.

In aggregate value terms, 1955 Soviet heavy industrial output was about a third of that of the United States. However, if we look below these figures, we find some very striking differences. For the most part, Soviet production of capital equipment was much closer to ours than is suggested by the average 33 percent. The outstanding example in this category is Soviet production of machine tools which, in this year, exceeded our production by 30 percent. On the

other hand, we produced almost 90 automobiles for every one produced in the U.S.S.R., 50 washing machines for every one produced in the U.S.S.R. and 5 radios and TV sets.

This is the appropriate point at which to introduce a word of caution. There are very great hazards in making comparisons of any two nations. This is especially so in a comparison of the U.S.S.R. and the U.S. In the former, the output of industry is state controlled thru a state plan to meet the needs of the state. In the latter, output is allocated thru the mechanism of free markets to meet the needs of the population. It is apparent that the U.S.S.R. may compensate in part for its lower absolute level of total output by channeling a high percentage of its resources to whatever goal it elects to emphasize whether it be a continued high rate of capital investment or a high rate of armament production. As the level of the Soviet industrial base rises, even greater freedom of action is permitted.

The principal long term economic task of the Soviets as expressed in the Sixth Five Year Plan, is "to overtake and surpass the most developed capitalist countries as regards per capita production".

This general objective has been amplified by Saburov (First Chairman, Council of Ministers) as follows:

"It is true that we have not yet caught up to the United States either in the volume of production per capita, and so far in the volume of industrial production per capita.

exceeds the pace of the growth of industry in the United States, permits us to overcome this lagging behind within a very short historic period of time".

If this goal is to be achieved it means that forced draft industrialization will be continued not only thru the Sixth Five Year Plan but beyond. It will be accompanied by low but very gradual improvement in standards of living, continued poor housing, few services, very expensive clothing and an adequate but uninspiring diet. Hours of work will be high by U.S. standards even though some further gradual reduction from the recently announced 46 hour week may be expected. The individual will have relatively little freedom to select either his occupation or place of work.

With the ultimate goal so identified, the Sixth Five Year Plan calls for a further increase in industrial production of 65 percent. This is a slightly lower rate than was planned for the preceding plan, a goal which is reported to have been overfulfilled. If this plan is met and assuming that the growth rates forecast for the United States are realized, Soviet heavy industrial production in 1960 will be between 40 and 45 percent of that of the United States.

Going from overall industrial goals to those for individual sectors, three additional aspects of the new plan may be of interest:

(1) The planned rate of growth of the energy sector will be somewhat higher than that achieved during the Fifth Five Year Plan, i.e., about 80 compared with 70 percent.

will be somewhat lower -- 70 percent in the Sixth Five Year Plan compared with over 80 percent in the plan period just completed.

(3) Finally, and this is most important, investment funds have been increased by about two-thirds over those allocated in the past period. Heavy industry undoubtedly will share generously in this.

Soviet plans for the next five years, if they are met, will significantly strengthen the U.S.S.R.'s war supporting potential. Over and above the general strengthening of the industrial base, it is expected that the output of the electronics industry, which contributes many essential items required in high-performance military equipment (including guided missiles), will be tripled. Also, in the field of special heat resistant alloys where the Soviets have done so much for fundamental research, the new five year plan calls for a six fold increase in production.

The achievement of the goals which the Soviets have set for themselves over the next five years will require a special type of industrial effort and will, at the same time, provide them with an industrial base more directly comparable to our own. Two factors are primarily responsible for this change in emphasis. First, additions to the labor force during the next five years will reach a low point owing to the lower birth rates during World War II. Soviet leaders expect that only about 7.8 million persons will be added to the labor force over this period compared to about 9.3 million during

the preceding five year period. Second, it is probably unlikely that a substantial diversion of labor from agriculture to industry will be possible within the next five years, if the ambitious agricultural output goals are to come anywhere near realization.

These facts suggest that there is very good reason for the present Soviet emphasis on increasing "per capita productivity" and for the recent continuing discussion of productivity, automation and the rationalizing of industry. The Sixth Five Year Plan calls for a 50 percent increase in productivity between 1956 and 1960. Soviet officials report a 45 percent increase in productivity during the last Five Year Plan but here again it should be observed that the base from which these increases are calculated is low by U.S. standards. Can the new goal be achieved? We have already commented on the major effort which the Soviets are making in the field of scientific and technical education. It is useful now to look at their plans for improved mechanization. Do they have command of the necessary technology? Two examples may suggest the answer to this question.

(a) The Soviets have placed very great emphasis on the production of machine tools. We have already observed that their output in 1955 exceeded ours by about 30 percent. Beyond their ability to produce these tools in volume they have the capability to produce complex high-precision tools. They have completed basic research on processes designed to conserve strategic materials such as ceramic tips for cutting tools and they have explored and developed the electro-spark method of metal removal.

As is true in a great many fields, the Soviets have an excellent command of the theory of automatic controls and are presently devoting a substantial effort to the development of these controls for industrial processes. Fully automatic lines for the production of anti-friction bearings and pistons have received a great deal of publicity in the Soviet press. The latter has been in production since 1950.

The Sixth Five Year Plan outlines in some detail Soviet plans for the future. These call for the introduction of automatic processes in the metallurgical, extractive, machine building, electro-technical, chemical and construction industries as well as a number of consumer goods industries. In the machine building industries it is proposed to put into operation some 220 automatic and semiautomatic lines and shops. Obviously, this is just a start.

In order to assure the rapid introduction of improved production processes, a new ministry has been created - The Ministry for Instruments and Means of Automation. In addition, new deputy ministers have been assigned to the various economic ministries to provide leadership for the development of these programs.

What this seems to mean is that the Soviets have now passed the point where expansion of output is to be achieved by simply adding more plant and equipment to the existing stock of capital. Questions of plant modernization and equipment replacement, of better work methods and processes will command increasing attention as the

(b) A second example of the directions of Soviet thinking with respect to technology may be drawn from the transportation field and current Soviet dissemination program. In late 1955, the Soviets announced a vigorous program to replace the steam locomotives on which they are presently dependent for over 90 percent of their railway haulage with diesel-electric and electric locomotives. By the end of the Sixth Five Year Plan, diesel-electric and electric locomotives are to account for 40-45 percent of all railway transport work; by 1965 for 80-85 percent. If the Soviets carry through this program as planned, they will accomplish a rate of locomotive replacement which roughly parallels our own experience in the years 1946 to date.

While this is indeed an ambitious program, the aspect of it which we would like to emphasize is the readiness of the Soviets to appropriate foreign technology and adapt it to their needs. The post-war diesel-electric locomotive initially put into production by the Soviets was an almost exact copy of the American Locomotive Company locomotive "Da". The engine to be used in locomotives planned for production during the next five years is an exact copy of the Fairbanks-Morse opposed piston engine used on ice-breakers.

It is possible to cite numerous other examples - tractors, construction equipment, road building equipment and motor vehicles - in which the Soviets have appropriated western technology for themselves, adapted it to their requirements where necessary and, in fact, used

the model as the base for further technological development. I need not point out to this audience that this practice must shorten the time period within which we will have a commanding technological lead. Moreover, this practice releases scarce scientific and technical manpower to work in those areas which have the greatest strategic significance to the Soviets.

That the rapid pace of Soviet industrialization has commanded a high price in terms of consumer living standards and particularly in terms of agricultural production is clear. Both manpower and investment have been diverted from the farms to the urban centers. The result is that the growth of agricultural output over the past two decades has been lower than the growth of population. It is useful to look at this problem for two reasons. First, the agricultural sector is one of the important areas of weakness in the Soviet economy. Second, paradoxical though it may appear at first glance, a resolution of this problem may well be found by continued concentration of effort on industrial growth.

Let me recite just two central facts concerning Soviet agriculture. Only about 10 percent of the U.S.S.R. is classified as arable and soils, rainfall, temperature and other climatic factors combine to provide good yields without large investment in only about one tenth of the arable area. Under the "New Lands Program" which has resulted in an 18 percent increase in sown area over the last two years, cultivation has been pushed into distinctly marginal

regions. Beyond this, output per farm laborer has been very low relative to that achieved in the United States. In rough terms, it has required about one farm worker to supply four persons in the U.S.S.R. compared with one farm worker for every sixteen persons in the United States.

What are the prospects for raising Soviet output per man and per acre? Substantial progress can be made by greater investment in farm machinery and it seems clear that this is one route the Soviets will take. Total agricultural investment during the next five years is planned to be about twice the level of the past five years. If this plan is met, the park of grain combines will be about double in 1960 what it was in 1955. Horsepower in the tractor park will increase about 75 percent during these five years and the rapid development of cultivator tractors will raise their share from 24 to 36 percent of the park. Greater expenditures are planned for repair and maintenance, for mechanizing livestock operations and for smaller wheeled tractors. Finally, expenditures on mineral fertilizers and livestock are to rise.

In response to these new investments, the Soviets are looking for extremely ambitious results; for example, an 80 percent increase in grain production, a 100 percent increase in meat production and a 154 percent increase in egg production in 1960 compared with 1955. If past experience is any sort of guide, however, these goals are likely to be quite substantially in excess of actual achievement. To meet them, Soviet state farm workers would have to increase their

productivity by 70 percent and collective farm workers by 100 percent during the next five years.

There is, however, one other approach to the agricultural problem which the Soviets may exploit regardless of how well they succeed in meeting their agricultural goals. As Soviet industrial capabilities rise and as costs of production decline, the opportunities for trading Soviet industrial commodities in world markets for agricultural supplies will undoubtedly appear increasingly attractive. Moreover, their economic capabilities appear to fit nicely with their political objective to increase the volume of trade with the underdeveloped countries. Thus it may well turn out that the industrial growth which the Soviets have pushed so aggressively will provide a solution not only to the problem of feeding the growing population but also the means for furthering their political ambitions in the underdeveloped areas of the world.

In my opening comments, I suggested that the industrial and technical challenge of the U.S.S.R. must be defined in terms of substantially increased military capabilities and increased ability to compete for markets throughout the world, particularly in underdeveloped areas. I have further suggested that the changing character of the Soviet industrial base is - far more than an end in itself - an essential prerequisite to the achievement of these goals.

In your evaluation of this challenge, I believe that there are six key points which you should seriously consider.

(1) While Soviet current output of industrial goods is about 30 percent of ours, their industrial output is increasing at a substantially higher rate than ours. During the past five years, their output increased by over 70 percent while ours was increasing about 23 percent.

(2) Assuming that the Soviets meet their Sixth Five Year goals, and assuming that we advance in line with present forecasts, Soviet heavy industrial production will be about 40 percent of ours by 1960.

(3) If anyone finds comfort in the above comparison, it may be wise to point out that overall comparisons of industrial levels can be very misleading. In a nation in which goods are produced to meet the needs of the state, it is possible to so allocate resources that output comparisons for particular commodities -- capital goods or military end items -- may be nowhere near so favorable to us as the overall averages suggest.

(4) Soviet emphasis on scientific and technical education coupled with emphasis on investment in capital equipment of advanced technological design indicates that important total output gains will be found through increasing output per man-hour.

(5) Soviet readiness to appropriate the advanced technological developments of western nations, and particularly the U.S., adapt these to their own requirements and make advances on them

according to their own priorities, has reduced and will continue to reduce the commanding lead which the United States has had in these areas.

(6) Soviet industrial expansion may well provide the means for improving domestic agricultural production and is well suited to advancing Soviet political ambitions in the underdeveloped areas of the world.